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Patterns of opioid prescribing for an orthopaedic trauma population

John Ruder, MD[1,2], **Meghan K. Wally, MSPH**[1,2], **McKell Oliverio, BS**[1,2], **Rachel B. Seymour, PhD**[1,2], and **Joseph R. Hsu, MD**[1,2] **the PRIMUM Group***

[1]Department of Orthopaedic Surgery; Carolinas HealthCare System, Charlotte, NC, USA

[2]Carolinas Trauma Network Research Center of Excellence; Carolinas HealthCare System, Charlotte, NC, USA

Abstract

Objectives—To determine opioid prescribing practices to the orthopaedic trauma (OT) population at one level I trauma center.

Design—A retrospective study of discharge prescriptions for adult OT patients. Prescription details, injury burden, and patient demographics were abstracted for patients from initial injury through 2 month follow up.

Setting—A busy level I trauma center.

Patients/Participants—Adult OT patients admitted over a 30-day period (n=110).

Intervention—All discharge and follow-up opioid prescriptions were recorded.

Main Outcome Measurements—Morphine milligram equivalents per day, Number of opioid prescriptions, type/dose of medication prescribed

Results—135 Discharge prescriptions were written for 110 patients with orthopaedic injuries during the review period (Table 1). All patients received opioids at the time of discharge (Table 2). The MMEs prescribed at the time of discharge was 114 mg (54–300 mg) for a mean of 7.21 days (2–36.7 days). While patients with pre-injury risk factors were prescribed discharge opioids for a similar duration (7.00 days, versus 7.30 days, p=0.81) than those without risk factors, they were prescribed significantly more MMEs than those without (130 versus 108, p<.05), and were more likely to receive ER/LA opioids than those without (42.11% versus 21.98%).

Conclusions—Pain management after orthopaedic trauma continues to be opioid-centric despite involving a population at risk. Further focus on prescriber and patient education, risk evaluation

Corresponding Author: Rachel Seymour, PhD, 1320 Scott Avenue, Charlotte, NC 28204, rachel.seymour@carolinashealthcare.org, Phone: (704) 355-6969, Fax: (704) 355-8708.

*A list of contributors can be found in an Acknowledgment at the end of the article.

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with mitigation, guideline development, and comprehensive pain management strategies are warranted in the orthopaedic trauma population.

Keywords

prescription narcotics; opioids; orthopaedic trauma

INTRODUCTION

Opioid-based narcotics are commonly prescribed for pain control in orthopaedic surgery patients and have a high risk for abuse and dependence.[1,2] In 2001, Joint Commission (JCHAO) introduced mandatory pain assessment standards in all patients and cited “pain is the fifth vital sign” as an example of a strategy for some clinical settings[3]. Concurrently, there was a massive marketing campaign by pharmaceutical companies promoting prescription opioids. This has resulted in the U.S. developing a largely pharmaceutical approach to pain management. The result is that the US consumes the majority of the world’s prescription opioids while representing less than 5% of the world’s population.[4] Concurrently, unintentional overdose deaths have risen sharply, largely due to an increase overdoses involving prescription opioids often obtained from a secondary non-medical source.[5,6]

Prescription opioid use now results in more deaths than cocaine and heroin combined each year.[7] Of the medical specialties in the U.S., orthopaedic surgeons are the third highest prescribers of opioids.[8] Studies have evaluated the prescribing habits of orthopaedic surgeons and the effect of opioids postoperatively during various procedures.[9,10] Patients with hip and ankle fractures treated in the Netherlands who did not receive postoperative opioids have been shown to have less postoperative pain and more satisfaction than patients with the same injuries in the U.S. who received opioids.[9,11] During this same time period, basic science studies have negatively influenced US Orthopaedic Surgeons attitudes about Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) in the setting of healing fractures, despite a lack of good clinical contraindication data and widespread use internationally.[9,11–13] This ushered in an era of opioid monotherapy for orthopaedic injuries. On the contrary, opioids are associated with worse clinical outcomes in patients with occupational musculoskeletal disorders and patients undergoing total knee arthroplasty, reverse shoulder arthroplasty, and spine surgery.[1,10,14,15]

Physicians and Non-physician providers who manage orthopaedic trauma patients should be particularly well-versed in risk assessment and mitigation strategies, since many in this population are at greater risk.[16–20] Massey et al. evaluated patients with a positive toxicology screen at the time of injury and found these patients to be at an increased risk for prolonged opioid use compared to those whose toxicology screen was negative.[17] In evaluating additional pre-injury risk factors, Helmerhorst et al. found patients with anxiety prior to their surgery had greater pain scores and post-injury disability compared to those without anxiety.[20] The study also found patients who continued to use opioids 1 to 2 months past their date of surgery had more disability and psychological distress than those who were no longer taking opioids.[20] Patients with pre-injury opioid use are more likely to have

multiple opioid prescribers postoperatively and continue opioids for a longer duration following surgery.[17,18] Substance abuse is another important risk factor for subsequent abuse of prescription opioids.[13] Moreover, rates of iatrogenically-induced addiction show wide variation and predictability in the literature[21–27] and increase with duration of exposure.[28–31]

Over the course of the past 20 years, Extended Release/Long Acting opioids like Oxycontin gained widespread use based on retracted claims of improved safety[32], and unsubstantiated claims of improved efficacy versus short acting opioids.[33–38] "Tamper resistant" extended release opioids were developed to curb abuse and misuse.[32,39] It has now been demonstrated that these drugs can still be abused and remain highly addictive.[40,41] Subsequent studies have not proven that extended release narcotics have greater efficacy than immediate release.[33–38] Despite these data and the FDA black label warning[42] in 2001 (updated in 2015), ER/LA opioids are still commonly prescribed. Another system implemented to identify patients at risk for opioid abuse and misuse are prescription drug monitoring programs.[43] Despite these efforts, the opioid epidemic continues to escalate, and a more comprehensive and efficient method to stratify and identify patients at risk for nontherapeutic opioid use is needed.[44] The purpose of this study is to determine the opioid prescribing practices in the orthopaedic trauma population at a single institution.

METHODS

Setting and Patients

A retrospective study of prescribing patterns at the time of inpatient discharge in adult orthopaedic trauma patients (including operative and nonoperative cases) admitted to a level 1 trauma center over a one-month period was conducted. Patients were discharged by either the Orthopaedic Trauma team or the Trauma Critical Care team. This audit was limited to one month, since it was conducted as a basis for a series of multi-disciplinary process improvements planned across the health system gradually over the next several months to years. All Orthopaedic Trauma discharges were conducted at the single Level 1 trauma center. The expansive health system (15 hospitals, 6 freestanding Emergency Departments (EDs), 30 Urgent Cares, and 350 clinics) on a common electronic medical record system was utilized to capture follow-up data on discharged patients. This is possible because the healthcare system maintains the dominant and growing footprint in a highly consolidated healthcare market. More importantly, the system scores highly in markers of patient loyalty like patient satisfaction and employee satisfaction[45–47]. Within system follow-up rates are quite high in both data analytic reviews and retrospective studies[48–51].

Data Collection and Measures

Discharge prescription details to include prescriber, drug, dose, and duration were recorded. The same details were recorded for subsequent outpatient prescriptions up to two months following discharge[20,52]. In addition, demographic information, including gender, age, and employment status, were abstracted from the electronic medical record into REDCap (Vanderbilt University, Nashville, TN)[53].

Relevant medical information abstracted included mechanism of injury, injury severity score (ISS), length of stay, and toxicology results. Daily morphine milligram equivalent (MME) dose was calculated for each prescription.[54]

We established a panel of subject matter experts from a diverse background of health care and public health to conduct an evidence based review to identify objective risk factors for abuse, misuse, and diversion.[39] This panel included members from Public Health, Orthopaedic Trauma, Addiction Medicine, Poison Control, Pain Management, Emergency Medicine, Internal Medicine, Trauma/Critical Care, and Information Technology[55]. Risk factors were further limited to those that were objectively searchable in the electronic medical record. Included risk factors were: 1) current opioid prescription with >50% remaining expected ("early refills"); 2) 2+ visits to the ED or Urgent Care with onsite treatment with opioids within the 30 days prior to the prescription; 3) 3+ prescriptions for opioids within the 30 days prior to the prescription; 4) any previous presentation for opioid overdose within the EMR; and 5) any positive screen for blood alcohol content (BAC), cocaine, or marijuana within the EMR.[56–65] We conducted focus group style interviews with prescribers to determine appropriateness of the thresholds of the risk factors. All urgent care and ED visits, as well as pre- and post-injury prescription information, was abstracted retrospectively from the EMR. Missing data was less of a concern, since limited our variables to orders/prescriptions, diagnostic codes, and lab results that are consistently and reliably documented within the EMR. Based on these risk factors, if a patient had one or more, they were classified as "at risk".

Data Analysis

Descriptive statistics were used to characterize the patient population and rates of opioid prescribing. T-tests were performed to determine if a difference in means existed for MME, duration of prescriptions, and number of prescriptions between patients receiving extended release vs. immediate release; as well as between "at risk" patients and patients without risk factors. Z-tests were used to detect a difference in proportion of "at risk" patients between those prescribed extended release vs. immediate release opioids. A significance level of 0.05 was used. Statistical analysis was performed using SAS.

RESULTS

135 Discharge prescriptons were written for 110 patients withorthopaedic injuries during the review period (Table 1). All patients received opioids at the time of discharge (Table 2). The MMEs prescribed at the time of discharge was 114 mg (54–300 mg) for a mean of 7.21 days (2–36.7 days). There was no difference in the mean MMEs prescribed at discharge between patients who underwent surgery and those that did not (117 mg versus 113 mg, p=0.70).

The most prevalent age group was 30–49 (28.2%) years. The most common mechanism of injury was a motor vehicle collision (32.7%). The mean ISS was 11.2. 53% of patients had at least one operative injury. ISS was not significantly different between patients treated operatively vs. nonoperatively. Fifty percent of the patients were unemployed at their time of injury, which is a risk factor for opioid overdose.[63] The mean hospital length of stay was 5.4 days (range 1–25 days).

At the time of admission, 33.6% received a toxicology screen. 16.4% of all presenting patients (almost half of those who were tested) had a positive BAC or toxicology screen for cocaine or marijuana (Table 3).

Patients who were prescribed extended-release oxycodone had a mean of 1.74 opioid prescriptions provided to them at the time of discharge, compared to 1.09 for those who did not (p= 0.53). Patients who were prescribed extended-release oxycodone at the time of discharge were prescribed significantly more MMEs than those who did not (149 mg versus 107 mg, p<.05). There was no difference in the ISS of patients who received extended-release oxycodone and those who didn't (12.3 versus 12.4, p=0.971). These ER/LA prescriptions were for a significantly longer duration after discharge (16.3 days versus 5.18 days, p<.05).

Twenty-five percent of the OT patients met some criteria that indicate risk for misuse, abuse, or diversion of prescription opioids upon admission for the baseline injury (Table 4). While patients with pre-injury risk factors were prescribed discharge opioids for a similar duration (7.00 days, versus 7.30 days, p=0.81) than those without risk factors, they were prescribed significantly more MMEs than those without (130 versus 108, p<.05), and were more likely to receive ER/LA opioids than those without (42.11% versus 21.98%).

During the 2 months of follow-up, 42.7% received at least 1 additional prescription for narcotics. The most commonly prescribed opioids during follow-up visits were hydrocodone-acetaminophen (36.4%), followed by oxycodone-acetaminophen (12.7%) and other opioids (2.7%). There was a mean of 0.37 visits per patient (range 0–4 visits) in which an opioid prescription was provided during the follow-up period. Patients were provided an average of 1.1 opioid prescriptions at their follow-up visit (range 1–4 prescriptions). The mean MMEs prescribed per patient during the follow-up window was 99.2 (0–555). Of patients that received a follow-up prescription, those with pre-injury risk factors received significantly more MMEs during their follow-up than those who did not (215 versus 79.5, p<.05). The opioid prescriptions they received during their follow-up visits were also for a significantly longer duration (11.8 days versus 4.37 days, p<.05). There was no difference in the number of prescriptions provided at follow-up between patients who received extended-release oxycodone at the time of discharge and those who did not (1.17 versus 1.1, p= 0.72). The difference in the MMEs provided at follow-up between patients who receive extended-release oxycodone at the time of discharge and those who did not was not statistically significant (142 versus 89.7, p=0.09). However, the opioid prescriptions they received during their follow-up visits were for a significantly longer duration (11.4 days versus 4.13 days, p<.05). The final opioid prescription was provided a mean of 1.82 weeks (range 0–13.3) post-discharge. Another 9.1% of patients demonstrated at-risk behavior[56–65] during the two-month follow-up.

DISCUSSION

Until very recently, there has been very little education to prescribers on pain management strategies[66–68] and risk other than the opioid monotherapy that has dominated the past two decades. Wide variance in prescribing practices to include the use of long-acting opioids

have been anecdotally noted in the trauma population, but publications in this area are lacking. Despite growing evidence of the link between prescription opioids and worse functional outcome, addiction, and even death, there has been a lack of translation of these data to clinical practice. Unfortunately, there has been limited education in the trauma community in the areas of risk mitigation, and non-pharmaceutical strategies for pain management.

Prescribers that are discharging orthopaedic trauma patients need to be aware that this is an at-risk population[17,18]. Risk Evaluation and Mitigation Strategies (REMS) should be employed in these patients.[69,70] Over 25% of the patients in this study had risk factors for abuse, misuse, or diversion of prescription opioids at the time of injury and were prescribed alarmingly high MMEs at the time of discharge. Patients who were prescribed extended-release oxycodone at the time of discharge received significantly more MMEs.

In the current study, almost 8% of this patient population had an existing/active opioid prescription with greater than 50% of the prescription remaining at the time of injury. Four-percent of the patients had received 3 or more opioid prescriptions within the 30 days prior to admission and 2% of the patients had 2 or more on-site emergency department or urgent care visits resulting in administration of opioids. Patients in this study with pre-injury risk factors received significantly more MMEs at the time of discharge, and during their follow-up visits than patients who did not. This is not only of concern because these are patients who will be at high risk of continued nontherapeutic opioid use after injury, but pre-injury opioid use has been associated with poor outcomes across multiple orthopaedic subspecialties.[1,14,15]

In evaluating orthopaedic trauma patients at the time of admission, Massey et al. found 72% of the patients to have either a positive BAC or toxicology screen.[17] This is of importance for multiple reasons. Patients with a positive toxicology screen on admission have been found to be at an increased risk for prolonged opioid use.[17] Nineteen percent of the patients in this study had either a positive BAC or toxicology screen for cocaine or marijuana on admission. This group of patients is at high risk for misuse or abuse of prescription opioids and strategies to mitigate this risk should be undertaken by prescribers throughout the inpatient stay and at the time of discharge. Clinical decision support built within the electronic medical record to identify risk for abuse or misuse would be a beneficial step to engaging in primary prevention by employing multimodal strategies and cognitive behavioral therapy to appropriately reduce dose and duration of opioid prescriptions.[71,72]

Furthermore, recognition that certain mental illnesses are risk factors for nontherapeutic opioid use[73] can help physicians direct more holistic treatment for these patients. Twenty-two percent of patients in this study had been diagnosed with anxiety at some point, and twenty-one percent of patients had been diagnosed with depression.

In this study of orthopaedic trauma patients who received a prescription opioid at the time of discharge, oxycodone-acetaminophen was the most commonly prescribed opioid. Almost one fifth of the patients in this study received a prescription for extended-release oxycodone at the time of discharge. The majority of these patients received an immediate release opioid

as well. Patients discharged with extended-release oxycodone averaged 149 MMEs and received 141 MMEs per day during their follow-up visits. These are both well above risk thresholds for overdose[5,74] and the maximum of 90 MMEs per day the Centers for Disease Control and Prevention recommends for treating chronic pain.[75] Despite the attempt to reduce the danger of OxyContin® with abuse-deterrent formulations, it is now clear that this remains a highly addictive drug with abuse potential as well as potentially devastating adverse effects.[40,41] The manufacturer of OxyContin® has paid over $600 million in fines for inappropriately marketing the drug as non-addictive and having less potential for abuse.[32] The majority of the literature citing the benefit and decreased abuse potential of extended release OxyContin® was funded by the manufacturer of the drug.[76–79] There has been a slight slowing of the increase in opioid related deaths in some states that is thought to be a result of stricter policies and regulations rather than the reformulation of OxyContin®.[80–83] The Academy of Orthopaedic Surgeons (AAOS) issued an information statement recommending against the use of extended-release opioids for the treatment of acute pain[84]. In the current study, all of the extended-release opioid prescriptions were written by non-orthopaedic prescribers. This study highlights that despite the risks associated with extended-release opioids, they are still being prescribed at alarming rates in an at-risk population in an opioid monotherapy regimen.

In addition to opioid prescriptions at the time of discharge, 43% of patients received an additional opioid prescription during the follow-up period. Care must be taken when prescribing opioids during follow-up visits, as opioid use one to two months past the date of surgery is associated with increased disability and psychological distress.[20] Data suggests that 50% of patients taking prescription opioids for 3 months will continue to take them at 5 years.[28] During the 2 month follow-up period of this study, an additional 9% of patients developed new risk criteria.

Unfortunately, there are no current clinical practice guidelines on pain management in Orthopaedic Surgery to include Orthopaedic Trauma[85]. Some guidelines do exist, like the CDC guidelines for chronic pain[75] and guidelines from other specialties and organizations[86]. Acute post-injury or post-surgery guidelines for pain management are scarce and demonstrate significant research gaps[87,88].

There are several limitations of this study. 1. It is retrospective in nature and limited to prescriptions provided within our healthcare system. The primary focus of the study is discharge prescriptions which makes it generalizable to any busy level 1 trauma center. Due to the large size of the health system in such a consolidated market, the follow-up data on prescriptions has some validity. 2. The sample size is small and limited to patients admitted over a 30-day period and followed for two-months after injury. This audit of prescribing practices was limited to one month to define the problem and target gaps for improvement. Subsequent to the audit, our health system began a series of interventions as an iterative improvement process that is still ongoing toward safer prescribing and appropriate, comprehensive pain management. 3. Patients who were previously prescribed opioids for cancer pain were not excluded. This is a patient population that is known to be prescribed higher MMEs per day than the general population. The number of cancer patients however should be quite small.

Management of pain following orthopaedic trauma is complex, and requires that surgeons be attuned to need to balance patient safety with the need to adequately and appropriately manage pain. Our results show that twenty-five percent of orthopaedic trauma (OT) patients have risk factors for abuse, misuse, or diversion of prescription opioids at baseline injury. An additional 9% of orthopaedic trauma patients became at-risk in the follow-up time period. These data suggest that a move away from opioid monotherapy into a more comprehensive pain management strategy to include multimodal pain management, cryotherapy, cognitive behavioral therapy[71,72] and others is needed. Orthopaedic practices and hospitals should develop standardized opioid prescribing protocols and encourage continuing medical education on opioid safety and appropriate use for physicians and non-physician providers that prescribe opioids.[89] To our knowledge, this study is the first to quantitatively evaluate the discharge prescribing practices in an at-risk orthopaedic trauma population. These data are essential as the first step in process improvement for safer opioid prescribing. Improvements should include the use of REMS, development and utilization of prescribing guidelines, and understanding of non-pharmaceutical strategies for pain management. Further, these data should compel clinicians to consider utilizing MME calculators and checking the state Prescription Drug Monitoring Database when prescribing opioids and to eliminate the use of ER/LA opioids for acute injury/pain. It also warrants a re-evaluation of the risk of Non-Steroidal Antiinflammatory Drugs versus opioids in the setting of musculoskeletal injury.

CONCLUSION

Pain management after orthopaedic trauma continues to be opioid-centric despite involving a population at risk. Further focus on prescriber and patient education, risk evaluation with mitigation, guideline development, and comprehensive pain management strategies are warranted in the orthopaedic trauma population.

Acknowledgments

PRIMUM Group (in alphabetical order):

Michael Beuhler, MD, Poison Information Center; Carolinas HealthCare System, Charlotte, NC, USA

Michael J. Bosse, MD, Department of Orthopaedic Surgery; Carolinas HealthCare System, Charlotte, NC

Emily Gerkin, Department of Orthopaedic Surgery; Carolinas HealthCare System, Charlotte, NC

Michael Gibbs, MD, Department of Emergency Medicine; Carolinas HealthCare System, Charlotte, NC, USA

Christopher Griggs, MD, Department of Emergency Medicine; Carolinas HealthCare System, Charlotte, NC, USA

Steven Jarrett, PharmD, Patient Safety; Carolinas HealthCare System, Charlotte, NC, USA

Daniel Leas, MD, Department of Orthopaedic Surgery; Carolinas HealthCare System, Charlotte, NC

Michael Runyon, MD, Department of Emergency Medicine; Carolinas HealthCare System, Charlotte, NC, USA

Animita Saha, MD, Department of Internal Medicine; Carolinas HealthCare System, Charlotte, NC, USA

Sharon Schiro, PhD, Department of Orthopaedic Surgery; Carolinas HealthCare System, Charlotte, NC

Bradley Watling, MD, Emergency Medicine Physicians; Carolinas HealthCare System, Charlotte, NC, USA

Stephen Wyatt, DO, Adult Psychiatry; Carolinas HealthCare System, Charlotte, NC, USA

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Table 1

Demographic data for the orthopaedic trauma population.

Characteristics	N (%)
Gender	
Male	70 (63.6%)
Female	40 (36.4%)
Age	
18–29	28 (25.5%)
30–49	31 (28.2%)
50–64	22 (20.0%)
65+	24 (21.8)
Mechanism of Injury	
Motor vehicle crash	36 (32.7%)
Fall <10 feet	24 (21.8%)
Motorcycle crash	16 (15.5%)
Other	10 (9.1%)
Fall >10 feet	9 (8.2%)
Employment Status	
Employed	53 (48.2%)
Unemployed	55 (50.0%)

Table 2

Discharge medications for the orthopaedic trauma population.

Discharge Medication	Percentage
oxycodone-acetaminophen	55.5
hydrocodone-acetaminophen	39.1
oxycodone	20.0
other opioids	3.64
benzodiazepines	2.73
morphine	1.81

Table 3

Selected Risk Characteristics of adult orthopaedic trauma population upon admission, including toxicology results upon admission and history of mental health diagnoses

Risk Factor	N (%)
Positive Toxicology Screen at admission for Alcohol, Marijuana, or Cocaine	18 (16.4%)
History of Positive Toxicology Screen in medical record for alcohol, marijuana, or cocaine	6 (5.5%)
Positive Alcohol	7 (6.4%)
Positive Opioids	6 (5.5%)
Positive Benzodiazepine	8 (7.3%)
Positive Marijuana	11 (10.0%)
Positive Anxiety	24 (21.8%)
Positive Depression	23 (20.9%)
Positive Bi-polar/schizophrenic	2 (1.82%)

Table 4

Risk Characteristics of adult orthopaedic trauma population at discharge

Baseline Risk Characteristics	**N (%)**
At risk baseline (met at least 1 trigger)	28 (25.5%)
Previous presentation for overdose	0 (0%)
3+ prescriptions within previous 30 days	4 (3.6%)
2+ on-site ED administration of opioids/benzodiazepines	2 (1.8%)
Existing/active prescription with >50% remaining	8 (7.3%)